

**REMARKS**

Claims 1-58, all the claims pending in the application, stand rejected. Claims 1, 12, 44 and 52 are amended. Claims 10, 15, 20, 51 and 58 are cancelled.

***Claim Rejections - 35 U.S.C. § 103***

**Claims 1-58 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Campbell et al (5,791,497). With respect to claims 13, 17, 22, 34, 40, 42 and 43, the combination of Campbell et al and Conway (5,164,795) is relied upon. With respect to claims 10, 15, 20, 51 and 58, the combination of Campbell and Aranda Lopez et al (4,221,297) is relied upon. These rejections are traversed for at least the following reasons.**

As a preliminary matter, Applicants note that the rejection as it applies to claims 10, 15, 20, 51 and 58 is moot in view of the cancellation of those claims.

With respect to the remaining claims, independent claims 1, 12, 44 and 52 have been amended to add limitations not found in the prior art, alone or in combination.

**Campbell et al**

In particular, the Applicants have reviewed the cited art and have noted that the primary reference to Campbell et al, encounters difficulties with regard to a shadow effect as seen in Figs. 7 and 8. This effect is disclosed at col. 7, line 61 - col. 8, line 67. Specifically, the image seen by the camera is one in which a crescent shaped "shadow" appears along the leading and trailing edges of the plant product, with a "hot spot" or bright portion in the center. The shadow may cause the processor 26 to declare the plant product defective, even though it is good. Campbell et al teaches that the shadow may be eliminated by diffusing the light with diffusers or by further separating the lamps to "kick up" the leading and trailing edges while diminishing the central "hot spot." A further approach preferred by Campbell et al is to eliminate the shadow by edge erosion or spatial filtering, as disclosed at col. 8, lines 21-64. As shown in Fig. 8, camera 22 takes three simultaneous images 112, 114 and 116 of belt 14 as the plant product passes through the scanning area 24. These images, which overlap, are processed to eliminate the shadow portions 118 and 119. The data read from memory is used to misalign images 112, 114, 116 so that the first four scan lines 121 of the image 112 replace the trailing "shadow" 118 of the image

114 with image portion 113. Similarly, the last four scan lines 122 of image 116 replace leading “shadow” 119 of image 114 with image portion 117. Thus, the shadows 118 and 119 are replaced with the images 113 and 117 of the belt and only section 120 of the image 114 is taken as the representative reflectivity of a plant product. Thus, a good plant product does not appear to be defective.

The present invention avoids this complicated problem by using one or more line scanners and one or more corresponding line detectors. Key to this process, however, is (1) the corresponding rotation of the plant product about an axis that is parallel to the direction of travel for the plant product and (2) the accumulation of plural line scan images for a given plant product so that a clear and shadow-less image is generated for analysis. Thus, light in the form of a line of light is aligned with the line of the linear detector field of view. Since the plant product is spinning during image capturing, particularly at a specific speed, a well defined plant product image may be generated without shadows.

There is no teaching in Campbell et al that the plant product would be rotated while an image is being taken. The use of a diffuser to eliminate shadows would only complicate and degrade the system.

#### **Aranda Lopez et al**

The reference is cited for use of a rotation structure that will ensure a plant product is inspected on all sides. However, the reference does not teach detection with a narrow field detector of a line of light *while* the product is rotating and traveling in a direction of the axis of rotation of the plant product. Aranda Lopez teaches at col. 6, lines 7 - 18 that the field of the camera includes more than three complete rows so that the camera can scan two complete rows simultaneously in its field of observation. There are two complete rows in each scanning cycle of operation and each plant product is examined in two consecutive cycles, thus achieving redundancy in examination. As explained at col. 5, line 28, once the plant product is placed on the conveyor rollers 5, they are turned so that the complete periphery is in the field of observation of a television camera 10. However, this is contrary to the teachings and limitations of the present invention in which only a narrow line of light and a narrow line of observation are

used, and the information in the plural detected lines accumulated for analysis of a single plant product.

It should be noted that the Aranda Lopez et al reference concerns a plant product that is small, such as an olive, and would not be suitable for the technique used in the present invention, namely one for citrus fruits such as lemons. The use of a line scan for a small plant product would be inconsistent with an efficient operation and unduly complicate the processing of the images. However, by contrast, the use of a line scan for the present invention yields highly reliable results and eliminates the problem with shadows and inaccurate detection of defective products.

Applicants have amended claim 1 to specifically state that the illumination light emitted towards an outer surface of a plant product is “a narrow beam defining a line of light on said outer surface (of the plant product) perpendicular to a travel direction of the plant product.” Further, the detecting step is further defined as detecting “with a narrow field of view overlapping said line of light on said outer surface.” Thus, the line of light on the plant product is matched with a detector that generates an image from the line of light. Further, the claim has been amended to add the step of “rotating the plant product about an axis parallel to said direction of travel and at a predetermined rotation rate.” Finally, the determining step has been amended to state that it is “in response to reflected light from a plurality of detected narrow beams accumulated sequentially as the plant product is moved and rotated in a direction of travel” to identify damage.

Similar amendments have been made to independent claims 12, 44 and 52.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

Amendment under 37 C.F.R. § 1.114(c)  
Application No. 10/727,491

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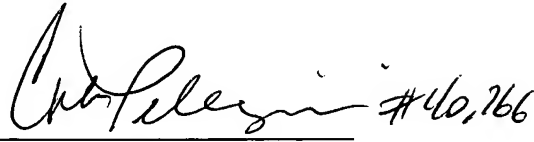
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